**Solar Basics**

**Energy from the sun**

Solar energy is the sun's rays (solar radiation) that reach the earth. This energy can be converted into heat and electricity. When converted to thermal energy, solar energy can be used to heat water for use in homes, buildings, or swimming pools; to heat spaces inside homes, greenhouses, and other buildings; and to heat fluids to high temperatures to operate a turbine to generate electricity.

Solar energy can be converted to electricity in two ways:

* Photovoltaic (PV devices) or *solar cells* change sunlight directly into electricity. Individual PV cells are grouped into panels and arrays of panels that can be used in a wide variety of applications ranging from single small cells that charge calculator and watch batteries, to systems that power single homes, to large power plants covering many acres.
* Solar thermal/electric power plants generate electricity by concentrating solar energy to heat a fluid and produce steam that is then used to power a generator.

There are two main benefits of solar energy:

* Solar energy systems do not produce air pollutants or carbon dioxide.
* When located on buildings, solar energy systems have minimal impact on the environment.

There are two main limitations of solar energy:

* The amount of sunlight that arrives at the earth's surface is not constant. It varies depending on location, time of day, time of year, and weather conditions.
* Because the sun doesn't deliver that much energy to any one place at any one time, a large surface area is required to collect the energy at a useful rate.

The amount of solar energy that the earth receives each day is many times greater than the total amount of energy consumed around the world. However, solar energy is a variable and intermittent energy source. The amount and intensity of sunlight varies by location, and weather and climate conditions affect its availability on a daily and seasonal basis. The type and size of a solar energy collection and conversion system determines how much of available solar energy can be converted into useful energy.

**Photovoltaic cells convert sunlight into electricity**

A photovoltaic cell, commonly called a solar cell or PV, is the technology used to convert solar energy directly into electrical power. A photovoltaic cell is a nonmechanical device usually made from silicon alloys.

The performance of a photovoltaic array is dependent upon sunlight. Climate conditions (such as clouds or fog) have a significant effect on the amount of solar energy received by a photovoltaic array and, in turn, its performance. The efficiency of most commercially available photovoltaic modules in converting sunlight to electricity ranges from 5% to 15%. Researchers around the world are trying to achieve efficiencies up to 30%.

**Solar thermal power uses solar energy instead of combustion to make electricity**

Solar thermal power plants use the sun's rays to heat a fluid to high temperatures. The fluid is then circulated through pipes so that it can transfer its heat to water and produce steam. The steam is converted into mechanical energy in a turbine which is then converted into electricity by a conventional generator.

Solar thermal power generation works essentially the same as power generation using fossil fuels, but instead of using steam produced from the combustion of fossil fuels, the steam is produced by heat collected from sunlight. Solar thermal technologies use concentrator systems to achieve the high temperatures needed to heat fluid.

Solar thermal energy can be also used to heat water or air. It is most often used for heating water in homes and in swimming pools. It is also used to heat the insides of buildings.

**Solar Energy & the Environment**

Using solar energy does not produce air or water pollution and does not produce greenhouse gases, but using solar energy may have some indirect negative impacts on the environment. For example, there are some toxic materials and chemicals that are used in the manufacturing process of photovoltaic (PV) cells, which convert sunlight into electricity. Some solar thermal systems use potentially hazardous fluids to transfer heat. U.S. environmental laws regulate the use and disposal of these types of materials.

As with any type of power plant, large solar power plants can affect the environment where they are located. Clearing land for construction and the placement of the power plant may have long-term impacts on plant and animal life by reducing habitat areas for native plants and animals. Power plants may require water for cleaning solar collectors or concentrators and may require water for cooling turbine-generators. Using ground water or surface water in some arid locations with significant solar potential may affect the ecosystem. In addition, birds and insects can be killed if they fly into a concentrated beam of sunlight created by a *solar power tower*.

http://www.eia.gov/kids/energy.cfm?page=solar\_home-basics